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ABSTRACT

This issue of the American Institute of Biological Sciences newsletter provides information about some new instructional programs tried out at different institutions. These include "Audio-Tutorial Innovations at a Small College," "A Learning Experience in Water Pollution," and "Human Nutrition as a General Education Course in Biological Science." A study is reported on the process of socializing graduate students into the profession of physiology. The behavior styles of physiologists are reported as a result of this study which reveals that physiologists are task-oriented people but often use socio-emotional means with other people. A questionnaire is provided for surveying manpower characteristics of biologists. Information is also provided about regional opportunities for workshops and resource utilization for teaching. (PS)

AIBS | EDUCATION DIVISION NEWS

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES • EDUCATION DIVISION

Volume 1/Number 6/December 1972

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AIBS MANPOWER QUESTIONNAIRE

While most other groups of scientists have conducted manpower studies, biologists have virtually no current manpower information about their profession. Therefore, your response to this questionnaire is urgently needed. Information obtained will be treated in strict confidence and used for statistical tabulations only. Name and address are not essential, but your zip code is required to allow tabulations by geographic region. Plans are being made for a MANPOWER SYMPOSIUM at the 1973 AIBS ANNUAL MEETING at which the results of this study will be reported.

NAME_____

ADDRESS_____

CITY_____STATE_____ZIP_____

1. Year of birth:_____

2. Sex: ___(1) female; ___(2) male.

3. Highest earned degree: ___(1)Ph.D.; ___(2)M.D.; ___(3)Masters; ___(4)Bachelors; ___(5)Assoc.; ___(6)No degree.

4. Have you had postdoctoral training?___Yes;___No.

5. Year of Bachelors:____. Year of highest degree: ____. Was your highest degree from: (1) a U.S. institution?____; (2) a foreign institution?____.

6. If you have attended graduate school, what was your major source of support: ___(1) U.S. Government; ___(2) non-profit organization; ___(3) foreign university funds; ___(4) U.S. university funds; ___(5) other foreign funds; ___(6) personal funds.

   Was any of your support awarded in the form of a competitive fellowship: ___(1)Yes; ___(2)No; ___(3)Don't know.

Omit any of the following items which are not applicable to your situation:

7. If you are seeking employment, indicate one most desired work activity: ___(1) administration/management; ___(2) research; ___(3) professional services; ___(4) teaching; ___(5) development/design; ___(6) technical/support services.

8. Indicate the type of present primary employer: ___(1) 2-yr. college; ___(2) 4-yr. college; ___(3) university; ___(4) elem./sec. school; ___(5) business/industry; ___(6) federal gov't.; ___(7) other gov't.

9. Basic annual salary before deductions for calendar 1972 to nearest $1,000: $___,000.

(9. Continued)
Estimated other professional income (honoraria, consulting, summer teaching, overtime, etc.) for '72: $___,000.
Basic annual salary before deductions for calendar 1971: $___,000.

10. Approximately how much of your current work receives federal support? ___(1) 100%; ___(2) 75%; ___(3) 50%; ___(4) 25%; ___(5) none; ___(6) don't know.

11. Use a "1" to indicate primary support and a "2" to indicate secondary support: __DOD; __AEC; __NASA; __NSF; __HEW-health; __HEW-education; __other_____.

12. Indicate relative level of rank or position in current employment. ___(1) senior; ___(2); ___(3); ___(4); ___(5) assistant.

13. While the question of minority status is a sensitive one, it is vital that we obtain such information so that we are able to evaluate the status of minority groups within the biological community. Although this information is not required, we would appreciate your cooperation. These data will be used for statistical purposes only. Check if you are a member of any of these groups.

___(1) Black
___(2) Puerto Rican
___(3) Mexican-American
___(4) Other Spanish speaking
___(5) American Indian
___(6) Other:_____

14. Are you presently employed: __(1)Yes; __(2)No.
If yes, check one of the following:
___(1) full time in one position
___(2) full time in one position with other employment
___(3) hold one or more part time positions
___(4) retired from profession but employed part time
___(5) postdoctoral fellow
___(6) employed but on notice of termination
If no, check one of the following:
___(7) student
___(8) retired
___(9) other not seeking employment
How long have you been in above status? ___(1) 1 yr. or more; ___(2) less than 1 yr.(no. of wks._____)

15. Regardless of current status, are you seeking employment? ___(1) yes; ___(2) no.

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16. Citizenship: ___(1) U.S. by birth; ___(2) Nat. U.S.; ___(3) Canadian; ___(4) Perm. visa; ___(5) Temp. visa. If not born in U.S., give year of entry into U.S._____.

17. Please use field codes below for this item:
Field of highest degree . . . . . Code_____
Field of Major employment last 5 yrs. . . . Code_____
Primary professional identification . . . . Code_____
Field of current employment . . . . . Code_____

18. Have you been unemployed at any time during 1972?
___(1) Yes; ___(2) No;. If yes, no. of weeks:_____

19. How many years of professional experience do you have? (Convert part time to full time equivalent)
___(1) none; ___(2) less than 1 yr.; ___(3) 1-2 yrs.; ___(4) 3-5 yrs.; ___(5) more than 5 yrs.

20. If you are academically employed, do you have tenure? ___(1) yes; ___(2) no.

21. For your current employment, indicate the approximate percent time in each type of work activity. Use the following code: 4=100%; 3=75%; 2=50%; 1=25%; 0=none.
___Administration/management ___Teaching
___Research ___Development/Design
___Professional services ___Other:_____
___Fellowship/Training

22. If your present employment includes a retirement program, have you acquired a vested interest* in your employer's contribution? ___(1) yes; ___(2) no; ___(3) don't know.
How many yrs. have you contributed to the program?_____

23. Check if you belong to any of the following societies:
___ AIBS; ___ Bot. Soc.; ___Amer. Soc. Micro.; ___ Ecol. Soc. Amer.; ___Amer. Soc. Zool.; ___other(s)_____
_____.
(Please check as many as apply.)

Codes:

01 biology, general	09 embryology	17 plant physiology	25 pharmacology/pharmacy
02 botany, general	10 entomology	18 plant pathology	26 other biological science
03 zoology, general	11 genetics	19 agronomy	27 interdisciplinary science
04 anatomy/histology	12 behavior/ethology	20 horticulture	28 physical science
05 biochemistry	13 nutrition	21 poultry science	29 social science
06 biophysics	14 animal physiology	22 wildlife management	30 arts/humanities, education
07 cytology	15 animal pathology	23 all other agriculture	31 mother/homemaker
08 ecology/environment	16 microbiology (bact., virol., Mycol., Parasit.)	24 medicine	

THANK YOU FOR YOUR COOPERATION IN COMPLETING THIS QUESTIONNAIRE.

___ CHECK HERE IF YOU WISH TO RECEIVE A REPORT OF THE ANALYSIS OF THESE DATA.

PLEASE FOLD AND MAIL TO THE ADDRESS BELOW. YOUR SUPPLYING THE POSTAGE IS GREATLY APPRECIATED AND, IN FACT, MAKES IT POSSIBLE TO DO THE STUDY AND SEND YOU A REPORT OF IT.

*VESTED INTEREST?
Item 22 on the manpower questionnaire asks: If your present employment includes a retirement program, have you acquired a vested interest in your employer's contribution? Having a vested interest in your employer's contribution means that if you were to terminate your employment, you would be entitled to the employer's accumulated contributions to your retirement. In some retirement programs, you acquire a vested interest at the time you begin participating in the program. In others, you may not acquire a vested interest until you have been with the employer three, five, ten or even twenty years. Do you know what your situation is?

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CROSS-FERTILIZATION

Graduate Education in Physiology

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The specific aim of this paper is to give the results of an exploratory analysis of the process of socializing graduate students into the profession of physiology taken as an example of a life science. The research strategy was designed to point up the distinctive qualities and emphasize the difference between a range of disciplines in the very revealing circumstances of the key socializing relationship, namely the graduate student-faculty relationship in university departments. All the data bear on the general hypothesis that the ideology of the specialist will strongly influence his social behavior style. The more specific and guiding hypothesis is that social distance between a specialist and his associates increases (1) with the hardness degree of experimental and statistical control of his typical research design and (2) with a decrease in the social relevance of his day-to-day work. The resulting data analysis was of two basic types: (1) a description of the salient, especially the distinctive features of graduate education, based on interviews, and (2) questionnaire data comparing the means and goals of graduate education as perceived by members of the department. Since the overall research design is that of a comparative exploratory case study, the hypotheses can only be demonstrated and not rigorously tested.

Participants in the study were 10 faculty and 25 graduate students specializing in physiology at a large public university in the midwestern United States. Much extrapolation was necessary, and the style of reporting is global and impressionistic, but all those members of the department who read the description seemed to agree with the account, with minimal qualifications. Unless stated otherwise, the bases for the separate facts in this description are comments and affirmations made in the interviews by students and faculty.

OCCUPATIONAL MOTIVES

Physiology is a laboratory science concerned most generally with why and how organisms work. Most students enter this field with a background of early interest in biology, but with a desire to work in a field which is a little more specific than straight biology, and at the same time integrates more knowledge, since it requires training in physics, chemistry, and mathematics. In this regard, the discipline is seen as very challenging.

Entering graduate students of today apparently know more about the scope of physiology than they did a dozen years ago (when Becker and Carper, 1956, did a study of these same departments). Nor is the field chosen as a second choice after rejection by medical schools, but rather as a research science, valuable in its own right. While the general public still accords very high status to the medical doctor, looking on him as "something of a god," thanks to the mass media and the greater educational level of most people today, there is more understanding and a more positive image of the scientist. He is no longer considered "a wild man creating babies in a test tube." Thus physiology is a growing field with a more erudite approach than that of the physician.

Once in graduate school, one's specialty is usually chosen on the basis of present research projects of the professors, both for convenience and to assure the funding of one's research. The result is that the range of possible research topics is rather limited, depending on the interests of the faculty. But within each such project, the student is usually given latitude to choose whatever specific line of research he chooses. In such a situation it is not unheard of for a student with well-defined interests to find that his interests are not served by any of the faculty in his department, and thus to switch to another graduate school with more compatible research interests.

METHODOLOGY

Research in physiology has special problems due to the difficulty of controlling all the variables in a living organism, especially the human organism. Work is thus carried on in a "messy" area at least compared to say biochemistry. At best, a quasi-experimental design for research can be used, with the result that there is much need for intuition and a good "feel" for what outcomes to expect. Oftentimes research is carried on by "muddling through," using an *ad hoc* pragmatic approach, and this in the face of the drive toward quantification and careful analysis. In this regard, biophysics has an advantage over straight physiology, where serendipity "rides high."

In general then, while the degree of specialization in this field is quite high for any particular piece of research, the level of abstraction in ordinary physiology is only moderately high compared to most areas of physics, chemistry or mathematics. At the same time there seems to be a strong tendency within the discipline to work on projects which have some ultimate practical applications, either for the practice of medicine or the advancement of knowledge about the human body. This tendency might well be strongly reinforced by the more ready granting of government funds for research in areas which have relatively more immediate, or at least potentially visible applications, e.g., in the space program.

Along with this tendency toward applied research, the very fact of the social relevance and human impact of their work makes the physiologists very much aware of their contribution to social betterment. In fact, very many of them find this as one of their motivations for studying in this area. While the practicing physician may be on the front line, with the contemporary high appreciation for science and its applications, the physiologist has little difficulty in seeing his role as making a definite contribution, with even potentially greater influence for human betterment than that of the practicing physician. This would seem to hold true even for those specializing in the more academic research of comparative and cellular physiology, as opposed to the more visibly applied research of those working in mammalian and human physiology.

SUCCESS

Success is usually defined in terms of doing the crucial experiment, implying a theoretical breakthrough. This requires a basic knowledge of the area in which one

is working as well as of related fields, which gives one a feel for biological principles, as well as competence developed by experience in the use of the tools of the discipline (electronic equipment, research methods, chemical procedures, etc.).

One's possession of these abilities is strongly facilitated by intellectual curiosity, which among other things helps one relate his little problem to the larger picture, or to the significant work going on in other areas of physiology and the life sciences in general. Naturally, one must be able to communicate his ideas, especially if he is to be a teacher, as well as to organize his ideas and strip away unnecessary information about a problem. Given such a background which obviously requires a certain minimum of native intelligence, the greatest help to success is simply the force of will which keeps one continually working at a problem until it is "broken," or until the right experiment is finally devised, an approach which seems to be characteristic of British researchers in this area.

Since it is impossible to gain experience and facility with all necessary tools while still in graduate school, it seems that the most frequent route is to get a postdoctoral fellowship working in some medical school or private or government laboratory. Beyond this, most of the desired positions obtained after one's formal training are as professors in physiology departments, most of which are affiliated with medical schools, though a minority prefer pharmaceutical research which is usually less prestigious, but pays well and gives one experience while on the job.

THE DEPARTMENT

Although still of probable relevance to physiology training generally, a few comments are in order about the particular department under study. A factor which cannot be ignored in the nature of the tasks performed by physiologists at work is the fact that research laboratories are usually moderate sized or small rooms, occupied by from one to five persons at a time, each with his own separate study desk placed adjacent to the research tables, apparatus, and other equipment, making it convenient to study while one is waiting for certain reactions in one's experiment.

BEHAVIOR STYLE

It will be proposed here that the above outlined characteristics of the discipline, especially as they are worked out in practice in the department under study, will have a strong influence on the behavior style of professors toward their students and between the students themselves both as professionals and as individuals apart from their profession.

In particular, the evidence seems to support the contention that the moderate degree of abstraction of research in this essentially quasi-experimental laboratory science, which requires small groups of individuals working in separate laboratories tends to account for, or at least correlate with, the lack of highly gregarious interaction, either among or between faculty and graduate students. The diversity of individual research specialties or projects again reinforces this somewhat restrained style of sociability.

Such restraint is indeed not necessarily a bad thing. Together with the diversity of interests, it makes it more difficult for department members to step on one another's professional toes. Perhaps for this reason there do not seem to be any notable factions or opposing schools of thought, only separation of interest, and a certain amount of expected clashing of personalities. On the other hand, many professors, especially the younger ones, usually assistant professors, are on a first name basis with their students or assistants, and drink beer with them on occasion (which seems to amount to something like a universal symbol of rapport with students).

The degree of social relevance of the physiologist's work, together with the relative "muddiness" or "softness" of methodology of his area of scientific research seems to be indirectly applicable and to correlate with the general sociability, warmth, understanding and tolerance for human variability seemingly characteristic of persons engaged in this work. Thus, while not ordinarily intimate, and not being unusually dynamic or assertive people, the physiologists are very straightforward in their relations with others. In general, one would expect such humaneness from people who have such a deep concern with world population, food and water, such things being as they are so essential to the survival of the human race.

Allied with such professional physiological concerns, there is a comparatively greater tendency than in most disciplines for a vocal minority of students as well as faculty to allow their enthusiasm for human problems to spill over into political activism, on such issues as war (in Viet Nam) and peace, as well as civil rights. Although there is a wide spectrum of members' views, and exceptions to the rule, the usually elder conservatives (say 50 years of age) are apparently outnumbered by the liberal and more active groups, both in politics, and it seems in religion. This of course goes along with a tradition of skepticism on religious matters in the biological sciences, apparently stemming historically at least back to the evolutionary theories of Darwin.

In addition, the general active concern of physiologists as people tends to show itself to some extent in their wide range of interests outside their specialty and less restricted circle of friends than is seen by them to be the case for the "typical academic person." While they generally lack the literary training of the humanists, many of them are interested in classical and modern music and literature, with a special place for books on exploring and preference for biographies (perhaps as inspiring to the scientist). There also appears to be something of a preference for outdoor recreational activities (at least among the young, which may have something to do with the relevance of plant and animal ecology to the professional concerns of the biological sciences, or perhaps with a need to escape the laboratory and journals during one's leisure hours).

Very briefly, the questionnaire survey yielded the following results. In their ratings of what they considered to be the actual case regarding means of education employed in their department, students felt that most emphasis was given to the factors of accessibility, rapport between faculty and students, and latitude given for subjective responses on the part of the students. The faculty generally agreed with student responses. Lesser in importance for both faculty and students were the factors of coordination of mutual actions, democratic interaction, and frequency of critiques given by faculty members to their students. The graduate students are satisfied with the degree of accessibility of faculty in their department, but dissatisfied with the frequency of

receiving critiques from the faculty. The faculty agree that students do not receive critiques frequently enough. However, faculty is satisfied with the amount of democratic interaction in their department.

In their rating of what they considered to be the actual case with regard to goals of education, both faculty and students considered career advancement as first in importance (or most achieved), with creativity and subject mastery ranked either second or third, followed by appreciation for ideas, development of personal and social values, and finally by nonrational sensitivity as a goal.

SIGNIFICANCE

The relevant sociological significance of this research is the fact that the physiologists generally use what we have called a "quasi-experimental" design for their research, since perfect control of all variables is impossible in most cases. The data provided an instance supporting the general hypothesis that the use of a moderately "soft" design, combined with a high degree of social relevance or potential social impact of their work definitely seems to have its carry-over effect on the typical social behavior style existing between the specialist (here the physiologist) and his colleagues or associates. The effect seems to be the warm, sociable, straightforward relationship, with a relatively low social distance between them. Although the means-goals questionnaire data shows that the physiologists are indeed task oriented, as might be expected for a scientific discipline, in practice it was found that they use socio-emotional means (e.g., accessibility and rapport) which was not altogether unexpected for such a socially relevant discipline. This latter fact tends to reinforce, or be reinforced by the interview data which, as we have said, reveals a rather close social relationship among the physiologists studied. Finally, the procedures, techniques, and types of data resulting should provide a model for future research on graduate departments focusing on student-faculty relations.

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"ERC Science Problems Course Will be Published Nationally by 1974" - that is the title of an article in the *ERC Reports* September issue. *ERC Reports* is published to serve the teachers and administrators in participating school systems by the Educational Research Council of America, Rockefeller Building, Cleveland, Ohio 44113.

REGIONAL NEWS

Audio-Tutorial Innovations at a Small College

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INTRODUCTION

Audio-tutorial practices at Athens College, a small liberal arts college, have provided a practical means of progressing toward an idealistic goal. The article entitled "Group Audio-Tutorial Instruction" by Lam *et al.* (5) prompted this effort to share those specific innovations which were necessary for using the audio-tutorial teaching technique here at Athens College in our small class, small school, small budget situation.

A thorough review of published information along with personal visits to a number of larger colleges and universities using the audio-tutorial technique convinced us in late 1968 that the method was superior to the standard lab-lecture technique being used currently at Athens College. We were convinced also that the technique could be inaugurated at Athens College with a small initial expense which would adequately meet the needs of our students.

Educational thought conveys the supposition that one student to one teacher is the ideal ratio. Practically, however, this seldom can be achieved due to the cost involved -- not only of monetary costs, but also the cost of that precious commodity -- teacher time. But practicality does not prevent educators from seeking effective ways of approaching the idealistic one-to-one ratio regardless of what we teach, how we teach, or where we teach. To this end, the audio-tutorial program at Athens College was inaugurated.

PROGRAM DESCRIPTION

Table 1 lists the equipment required for initiating the first semester of freshman biology at Athens college. The largest class enrollment has been 62 students, but the equipment listed in Table 1 would serve a class size up to 100. Study carrols were constructed in the back of one of our laboratories which was and continues to be used for teaching advanced biology classes every term. This situation has proved workable for us. Portions of commercially available study guides (7, 9) are used, along with a textbook (10) and several supplementary, optional references (4, 6, 8). The course is scheduled in a 2-hour block of time Monday, Wednesday, and Friday, which provides ample time for group meetings and testing, but does not create difficulties in scheduling for the Dean.

The course utilizes 3 basic components: 1. a General Assembly Session (GAS), 2. Seminar Sessions (SS), and 3. Independent Study Sessions (ISS). The GAS sessions are conducted on Mondays. At this time, learning objectives are distributed to the students. Movies, film strips, slides, reviews of previous work, explanations necessary for the current unit's work, and sometimes guest speakers are presented at this session. Major exams are also given at this time.

Seminar Sessions (SS) are conducted for groups of 10 or less students. At this time, the current unit

of study is discussed in an informal atmosphere. If students do not keep the discussion going with questions for the instructor, the instructor begins questioning students individually. A 20 point written quiz is usually given during this session. The Seminar Sessions represent the strongest point of our current program. Students invariably rate the weekly quizzes, learning objective sheets, and seminar sessions as the most beneficial aspects of the course.

The ISS can occur at any time the student chooses. The biology laboratory is open from 8:00 a.m. until 10:00 p.m., Monday through Friday. Students performing their independent study are truly "on their own." However, the biology faculty offices are near the laboratory area and students are encouraged to seek help as they need it. This is a major weakness of the current program since many who need help will not seek it. An effort to remedy this situation will be attempted by the staffing of the laboratory for 3-4 hours each afternoon (M-F), and by requiring individual performance via short oral quizzes during laboratory hours.

Extra research is encouraged. Students are given a list of *Scientific American* offprints that are considered to be relevant to the course. Articles read and documented by a short oral or written report are valid for two extra points per article. Other options available include the presentation of research reports in seminar sessions, and independent research projects. The better students are the ones who usually take advantage of these options.

The first semester course of freshman biology was successfully taught via the audio-tutorial method for six semesters. In the fall of 1971, additional equipment (Table 2) was purchased for incorporating the audio-tutorial teaching method into the second semester course. With class size averaging about 50 students, less equipment was needed. Course organization remained essentially the same. The same textbook was used (10) as well as portions of the same study guide (2, 9). A study sheet was given each student approximately one week prior to each major exam. This study sheet contained questions similar to those to be expected on the exam itself. This practice seemed to eliminate a great deal of the fear, anxiety, and uncertainty from taking the major exams. Most students enthusiastically endorsed this practice as a useful aid to learning while rejecting the idea that it made the exams "easier."

The Wollensak recorder has enabled us to produce higher quality tapes. Sound quality has not been a problem at any time, however. The Graflex Audio-Study-Mate tape players include a film strip viewer. This feature enables us to include more film strips into our audio-tutorial units.

RESULTS

Even in a small college situation, we have found audio-tutorial teaching enables us to offer more individualized teaching to our biology students. Evaluations by faculty and student-assistants involved in teaching the course, and feedback from students taking the course enthusiastically endorse the course as being superior to the "standard" approach to teaching freshman biology courses. Students say they learn more, at their own speed, at their convenience, and it allows them to pursue to greater depths the subjects in which they are most interested. Faculty members in charge of the course find that they have more intimate relationships with their students as individuals. The audio-tutorial technique provides a closer approach to individualized teaching in our freshman biology courses here at Athens College.

ADDITIONAL INNOVATIONS

"Contract teaching" has been successfully implemented in our course in Human Anatomy and Physiology (11), and in the laboratory portion of Genetics (3). This new teaching technique has been favorably accepted by students because they are allowed more options as to what they learn and the speed with which they learn. In both courses, there are a few required "clauses" deemed necessary for a minimum level of laboratory performance and subject mastery and several clauses from which the student may choose the things he wants to do and learn. Group experiments, individual laboratory experiments, dissecting techniques, Drosophila handling techniques, literature searches, learning to use visual aid equipment, and oral and written quizzes (sometimes individualized) are examples of the types of "required" and "optional" clause learning activities comprising the "contracts." Lecturing is kept to a minimum. It is our conviction that students retain techniques and practical knowledge gained from laboratory work and individually conducted study much longer than the descriptive jargon included in most lectures.

Contract teaching requires essentially no additional expense. In fact, less equipment and fewer supplies are usually necessary for an equivalent student population. We are currently considering ways in which this teaching concept can be incorporated and utilized within the framework of our audio-tutorially taught freshman biology courses.

As a result of our efforts to improve instruction here at Athens College, our acquired experience with teaching innovations, and our expressed desire to conduct further teaching technique research, a Title VI grant was recently approved for purchasing video-tape equipment. We plan to incorporate and use this equipment to supplement and/or gradually replace the currently-used tape recorders. Hopefully, this will lead to the development of what might be called the "video-audio-tutorial teaching technique." Very recent development of cassette video tapes and associated equipment (1) make the idea an even greater possibility.

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Table 1: Equipment Costs for First Freshman Biology Course

No.	Item	Unit Costs	Total Cost
6	Sony Tape Recorders TC Tape Recorders (Models TC 900 & TC 900A)	$69.50	$417.00
6	Telex Headsets (Model 600)	5.95	35.70
120	Reel-to-reel one hour tapes	1.86	223.20
6	Film Loops	19.58	117.48
1	Film Loop Projector - Consigned to Biology Dept. by Visual Aids Sept.	---	---
	Miscellaneous Items	---	25.00
	TOTAL COST:		$818.38

Table 2: Equipment Costs for Second Freshman Biology Course

No.	Item	Unit Cost	Total Cost
1	Wollensak Cassette Tape Recorder (Model 2550 AV)		$299.95
3	Graflex Audio-Study-Mate Tape Players	$79.95	239.85
72	Cassette Tapes (C-60)	.98	70.56
4	Film Loops	22.95	91.80
	Miscellaneous Items (including three more headsets)	---	22.55
	TOTAL COST:		$724.71

A Learning Experience in Water Pollution

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Dayton, Ohio 45409

INTRODUCTION

Water pollution has evolved because of industrial-urban growth and development over the past 70 years (Hennigan, 1969). It provides stimulation for education that cannot be experienced in the classroom. A group of high school and college students from Dayton, Ohio, spent five summer months participating in a study designed to acquaint them with some of the problems of water pollution. Aspects of this study may be incorporated into high school or college environmental science programs.

MATERIALS AND METHODS

Samples for chemical analysis were collected on weekdays. Each site was analyzed three different times and the results were averaged. Samples were collected at a point where the outflow entered the river or stream. All samples were analyzed within twenty-four hours with a LaMotte Chemical Kit (The LaMotte Chemical Products Company, Chestertown, Md.)

A 10 x 4 foot seine with one-quarter inch mesh was used to collect fish at selected sites. Invertebrates were collected at certain sites by filtering the benthos. Aquatic life was sampled in close proximity to the point where the chemical sample was obtained. The fish and invertebrates were identified using the keys of Eddy and Hodson (1961) and Needham and Needham (1962). Dissolved oxygen (D.O.) was measured with a Y.S.I. Model 54 Oxygen Monitor (Yellow Springs Instrument Co., Yellow Springs, Ohio). The IMViC tests (Anderson, 1969), Eijkman test (Clark and Kabler, 1963) and EMB (eosin methylene blue) agar (anonymous, 1969) were used to distinguish fecal coliforms *(Escherichia coli)* from non-fecal coliforms *(Enterobacter aerogenes).*

RESULTS

A warm effluent with small quantities of dissolved solids, iron and phosphate was released at site A (Table 1). Several species of fish were identified from this area including yellow perch, black bullhead, rockbass, largemouth blackbass, smallmouth blackbass, golden redhorse, creek chub, carp, gizzardshad, shiners, sunfish and goldfish. The benthos included larvae of caddisflies, mayflies and blackflies as well as fingernail clams and snails.

At site B, the bottom was covered with 15 to 24 inches of white muck. The pH was alkaline and the water contained considerable amounts of phosphate, iron, and dissolved solids (Table 1). The D.O. was 17.5 ppm upstream and 3.0 ppm downstream of the outflow. Site C yielded small amounts of cyanide and carbon dioxide (Table 1).

A white effluent with considerable alkalinity and hardness was discharged at site D (Table 1). The discharge was visible for more than 2,000 feet downstream, but had little effect on D.O. Site E appeared to be clean, except for a discharge of iron which coated nearby rocks.

At site F, the effluent contained solvents and oils in addition to dissolved solids, CO_2, iron, phosphate and chromate (Table 1). Also there were suspended solids that coated the bottom and bank for several hundred feet downstream.

The small amount of magnesium and calcium discharged at site G made it the cleanest of all sites with the possible exception of sites H and K (Table 1). However, at site H there were large quantities of suspended solids that covered the bank and bottom.

In comparison, sites I and J were probably the most polluted. The effluent at site I contained significant quantities of phosphate, ammonia, calcium, magnesium and chloride (Table 1). Utilizing the Eijkman and IMViC tests and EMB agar, we demonstrated that over 50 *E. coli* per ml were present in the effluent. In addition, the stream bottom and rocks were covered with grey-green mats of *Sphaerotilis*. At site J the effluent was warm and contained significant quantities of iron, phosphate, chloride and dissolved solids (Table 1). Moreover, quantities of suspended solids and oils produced an oily mud which covered the bottom and rocks. Seining revealed only minnows and shiners were present. The bottom was also covered with *Sphaerotilis* and *Tubifex*.

DISCUSSION

To achieve our goal of developing an interesting, educational approach to the study of water pollution, we chose methods of analysis that were challenging but not requiring a high degree of technical skill. The chemical test methods used are recommended by the American Public Health Association and the equipment produces reliable reproducible results without highly trained technicians (C.V.B. LaMotte, personal communication).

As an introduction to limnology, potamology and water pollution, all participants were encouraged to read three short paperbacks by Amos (1969) and Renn (1968, 1969). Throughout the summer, spontaneous informal gatherings were held to discuss the results. These proved to be an invaluable aspect of the program and form the basis of the "discussion" below.

The problems of thermal pollution are well known (Kennedy and Mihursky, 1967; Krenkel and Parker, 1969a, b; Coutant, 1970) and may be studied in the field or in the classroom with simple laboratory experiments. The warm effluent at Site A provides a suitable habitat for a large and diverse fish population. Similar results were obtained during a study of the Connecticut River (Merriman, 1970). We also learned that in Texas, warm effluents are used to increase fish productivity (Drew and Tilton, 1970).

The D.O. of streams and rivers depends on oxygen production from riffles and photosynthesis and oxygen consumption by aquatic organisms and oxidation of metals (Ellis, 1937). The amount of oxygen consumed by organisms is measured as the Biochemical Oxygen Demand (B.O.D.). Although we did not measure B.O.D., we recommend it as a measurable parameter for similar studies since it provides additional information on the quality of the water being sampled. The low D.O. downstream of the effluent discharged at site B probably results from oxygen depletion by oxidation of metals and suspended solids. At site D, considerable quantities of magnesium were discharged, but apparently did not consume oxygen downstream. Since the stream bank, rocks, sticks, etc., were covered with solidified effluent, we suggest that the material precipitated and was not released downstream to be oxidized.

Several of the effluents contained metals and were alkaline. Often the toxicity of a metal is pH dependent, e.g. HCN rather than CN is toxic to fish (Doudoroff, Leduc and Schneider, 1966). Because of the alkalinity of all effluents, we suggest that CN is not a determining toxic factor to fish at any site. However, ammonia is often more toxic under alkaline conditions (Doudoroff and Katz, 1950); in fact at pH 8.0, the ammonia concentration should not exceed 1.5ppm (Ellis, 1940). At site I, the effluent has a pH of 8, exceeds 1.5ppm and may be a determining toxic factor to aquatic life.

At all sites we found insignificant quantities of copper, sulfide, chromate, carbon dioxide and chlorine and we do not consider these as pollutants. Similarly, iron, although present above permissible criteria at a few sites, is usually not a major pollutant except in acid mine drainage. We arbitrarily defined a pollutant as any chemical in the wrong place at the wrong time at the wrong concentration.

At several sites (A,B,D,F,H,I,J) phosphate is present above permissible criteria. We learned that phosphates (Taylor, 1967; Hudson and Marson, 1970; Lee, 1970; Hammond, 1971) or nitrates (Ryther and Dunstan, 1971) may promote eutrophication. Recently, Mitchell (1971) substantiated that phosphates in detergents are not the sole factor promoting eutrophication. At no site did we notice algal blooms which are associated with eutrophication and phosphates. Therefore, we suggest that phosphate does not stimulate algal blooms at any of the sites.

At sites F and J we detected the presence of oils and solvents. At the latter site an oily mud coats the bottom and bank permitting growth of the sewage fungus, *Sphaerotilis*, and the sludge worm, *Tubifex*. In contrast at site A, where there are less pollutants, sensitive and facultative organisms (Keup, Ingram and Mackenthum, 1966) are present. Sampling these two sites gave us the opportunity to compare a habitat supporting tolerant organisms with one supporting facultative and sensitive organisms.

We learned that the operation at site I is designed to treat 320,000 gallons of waste per day and that during our survey the average daily outflow ranged from 430,000 gallons to 750,000 gallons. The result is the discharge of some raw sewage. The IMViC tests permit differentiation of *E. coli* and *Enterobacter aerogenes* because both organisms have different fermentation patterns when cultured on glucose and both possess different enzymes for production of indole and permeability of citrate. We also used the Eijkman test where fecal coliforms produce gas from glucose at 46°C, but non-fecal coliforms do not. We used these tests to learn about the physiology of these bacteria as well as to distinguish them. On EMB agar *E. coli* produces shiny black colonies and *E. aerogenes* produces colorless colonies. We used this agar to determine that the number of *E. coli* exceeds the State's limit (Anonymous, 1970). We learned that the situation at site I will be corrected by a new plant which is under construction.

The other sites all discharge their waste into storm

sewers which discharge directly into rivers and streams. To comply with the State's regulations, all waste will be tied into sanitary sewage systems or be treated at the plant.

Wolman (1971) recently reported on the problems encountered in appraising water quality. One problem that we encountered was the gradual decrease in water level of the streams and rivers as Summer progressed. This increases the concentration of pollutants and may influence their toxicity to aquatic life. This should provide additional stimulation to remove the pollutants from the discharges.

Since our work was completed, two similar projects were initiated in the departments of Chemistry and Physics. A program similar to ours has been in operation in the Biology Department of Heidleberg College for three years. Variations of this type of study include limnological weekends (Stewart, 1971) and summer field projects (McGowan, 1969).

Our work enabled us to (1) perform chemical analysis of several sites without a high degree of technical skill; (2) learn the basic principles of limnology and potamology; (3) derive a basic understanding of what organisms may subsist under certain environmental conditions; (4) familiarize the participants with some principles of field research; and (5) examine the possible solutions to the problems. Since momentum towards environmental education is increasing, we suggest that similar studies be incorporated into high school and college environmental science programs.

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Table 1. Water Quality Criteria for Each Site

Parameters Tested	Sites												Permissible Criteria
	A	B	C	D	E	F	G	H	I	J	K	L	
Temperature	95°F	93°F	84°F	73°F	86°F	84°F	---	---	---	97°F	---	75°F	<95°F
pH	8.3	9.2	8.3	8.9	8.2	7.5	7.8	8.4	8.0	9.1	8.0	8.4	<9.0
Alkalinity	200[a]	650	100	2200	200	140	200	210	---	100	---	150	---
hydroxide	40	0	0	0	0	0	0	0	---	100	---	0	---
carbonate	160	114	20	1320	0	0	0	14	---	0	---	14	---
bicarbonate	0	536	80	880	200	140	200	196	---	0	---	136	---
Hardness no.	300	500	350	2500	500	250	600	---	325	---	---	230	---
magnesium	240	250	100	2400	200	100	350	---	213	---	---	110	---
calcium	60	250	150	100	300	150	250	---	112	---	---	120	<200
Copper	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<1.0
Sulfide	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	---	<0.2	0.4	<0.2	<0.2	<0.2	---
Ammonia	<1.0	<2.0	<1.0	<1.0	<1.0	<1.0	---	---	20	<1.0	1.0	<1.0	<0.5
Carbon Dioxide	0.0	0.0	2.0	0.0	5.0	7.5	---	---	0.0	0.0	---	4.0	<10
Chlorine	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	---	---	<0.1	<0.1	---	---	---
Chloride	35	75	46	75	50	50	---	50	235	1250	---	---	<250
Cyanide	<0.05	0.2	0.1	<0.05	<0.05	<0.05	---	---	<0.05	<0.05	0.15	0.15	<0.2
Chromate	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	---	---	<0.5	<0.5	---	<0.5	---
Iron	0.3	0.5	<0.3	<0.3	1	0.4	---	0.5	0.5	0.3	<0.3	<0.3	<0.3
Phosphate	1.0	8.0	<1.0	2.0	<1.0	20	---	1	20	3	<1.0	<1.0	<1.0
Total dissolved solids	810	1110	340	3175	450	5800	---	---	700	3300	---	440	<1000

[a]Parts per million

DIALOGUE

Human Nutrition as a General Education Course in Biological Science

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We have had some success at Antioch in offering an undergraduate general education course in human nutrition. This course began 3 years ago in response to a letter in the college newspaper written by a student who was working on his cooperative (work-study) quarter in Washington, D.C., in a Migrant Research Project. This student was Chris Bradford, a social science major, who was concerned about the nutrition of migrant workers in the United States. Chris' letter requested an informal seminar in Nutrition. I assumed responsibility for this course in the Summer quarter and prepared for the 10-15 students that we expected in the Fall. Both Chris and I were surprised when 120 students showed up at out first meeting.

With ample student motivation and interest, we launched a course that included many innovations. This article will outline the substance of this course, and also indicate why it is a useful offering in biology for both majors and non-majors.

The syllabus for the nutrition course stated its purpose: "This course deals with the science of food and health. In this context we will study the many areas of biology that are related to nutrition and become as well-informed as possible. It is important that we share information on the personal, physiological and social aspects of nutrition, because each person will have his own area of interest and his own project. Together, however, we will cover basic nutrition in some depth."

Our text was *Nutrition and Physical Fitness* (2), which covered basic nutrition very well, but in other respects was not up-to-date enough for our needs. For recent work and material, we used many other resources which were kept on reserve in the library or in a special nutrition library in the Science building.

We were fortunate, during the first year, to have some outside support from the Alfred P. Sloan Foundation. The grant to Antioch College was for the improvement of teaching in the Sciences. Some funds were available for student assistants, materials, books, outside speakers, etc.

To give you an idea of how the course was conducted, let me relate some of the activities that were going on during the quarter. First of all, the course was organized for (1) lectures to be given twice a week, (2) a session for outside speakers, a movie, or whole class discussions, and (3) a small group session that met once a week for discussion or lab or an occasional field trip.

Lecture topics were chosen to supplement the text and, in general, contained new material. The subjects included food composition, carbohydrates, proteins, lipids, vitamins, minerals, food absorption, utilization, deficiencies, excesses, stress factors, the role of microbes, naturally occurring toxins, preservatives, agricultural residues, ethnic diets, drugs, food technology, food fads and diets, malnutrition and mental retardation, obesity, aging, and other topics.

The individual (or group) projects provided for an in-depth study in some area of nutrition, chosen by the student. The only requirement was that the results of this effort be brought back to the class and shared in a discussion, a presentation, a paper, or a demonstration of some sort. These were scheduled for the laboratory discussion periods toward the end of the quarter. These reports were variable in quality, but a significant number were good and a few were excellent.

A wide range of subjects was chosen for study. Among the more popular were personal diets of students, social or psychological aspects such as ghetto problems, ethnic diet patterns, and macrobiotic or vegetarian diets. Other topics were fasting, vitamins, preservatives, mental retardation, food value and cost, drugs, food processing, cafeteria food, proteins, herbs, fermentation products, food additives, metabolic diseases, world food and population problems, excesses or deficiencies, pregnancy, digestion, food composition, microbial aspects of nutrition, and agricultural, medical or legal subjects related to nutrition.

The outside speakers provided important new perspectives of nutrition. For example, we had a nutrition aide from a Cleveland ghetto tell about the nutrition problems among the black people of America; an agent from the Agricultural Extension Service reported on their work in communities in nearby Dayton. In this latter instance, several students volunteered to work with children in the Extension Service home nutrition program; this continued for several quarters. Another speaker was a dietician from a nearby hospital; this contact later led to a class visit to the hospital. Other speakers were an expert on the effects of malnutrition and brain development, and a chemist explaining his view of proteins, carbohydrates, and lipids.

In the laboratory part of the course, we have run hemoglobin colorimetric assays and discussed the data in relation to the need for iron, its uptake and importance. We also have run simple urine tests when students have gone on fasts; in this way they can monitor certain parameters of their physiology. A file of reports on various fasting experiments which students undertook were placed on file in the laboratory. Students were required to read these before deciding on their own fasting regime. Usually students expressed a determination to try a fast for their own reasons. Our reasoning was: if they are going to do it anyway, we wanted them to know what they were doing, learn from the experience, and report to the class. Now, any student contemplating a fasting regime for a few days or a week can consult these reports and resource books on the subject.

One exercise which all students participated in was a "Daily Dietary Intake Chart." They were asked to take the food of a typical day, weigh all of it, and then determine the nutritive value of this food, using the two main sources *Composition of Foods* (7) and *Food Values* (4). The values for protein, calories, minerals and vitamins were then compared to the Recommended Daily Dietary allowances of the Food and Nutrition Board of the National Research Council, for their age and sex. The data from the charts of all members of the class were then tabulated to give the mean and the range of values for various dietary components. We also compared women and men, vegetarians, coffee drinkers, intake per unit body weight and so on. This was an important exercise and alerts the stu-

dent to the array of foods he eats and what they provide. In some instances, an analysis of protein quality was made to show the content of essential amino acids. This information was best obtained from *Food Values*. The discussions which followed were often concerned with protein complementarity, malnutrition, quality of protein, and so on.

There are a number of good resources that aid in keeping up-to-date on the current status of nutrition. The scientific journals, of course, are an important medium. *Nutrition Reviews*, *Journal of Nutrition*, *Amer. Jour. of Clinical Nutrition*, and *Jour. Amer. Dietetic Assoc.* are a beginning. We also use *Nature*, *Science*, *Nutrition Today*, *Jour. Amer. Med. Assoc.* and other sources as well. Many resource books are also kept on reserve at the library (some important ones are given in the references). In addition, we have assembled a nutrition library, as we call it, in the laboratory-discussion room. Here we keep the pamphlets, articles, reprints and a wide variety of literature on nutrition which has been collected from various sources. A few of the best sources are The National Dairy Council; The League for International Food Education; The National Research Council; National Academy of Sciences; The Protein Advisory Group, United Nations; The American Dietetic Association; American Dry Milk Institute; American Institute of Nutrition; Cereal Institute; American Medical Association; and the local County Extension Office of the United States Department of Agriculture.

The field trips for the course were not more than 2-3 per quarter. However, they were an important element in making the course a group learning experience. We move away from the classroom and search the neighboring countryside for some institution, hospital or farm for new perspectives on nutrition. Our trips have taken us to the local grocery store to examine foods on the shelf, a meat packing and slaughter house, a dairy, a brewery, an organic farm, a grain mill, several times to a large bakery, a hospital, a textured vegetable protein manufacturing plant, a hybrid corn seed breeder's farm, and a cheese factory. Once in the quarter we schedule an extra class period to go down to the local super market. There we discuss food values, price per amount of protein, protein quality additives, etc., and make comparisons. We have some reference books with us and always make some interesting new observations; these serve to alert the student to carry on this form of inquiry on their own.

During one quarter there was a Symposium on Proteins at nearby Ohio State University. Arrangements were made for 30 students to attend the Symposium and hear papers by some of the leading authorities on food proteins. The meeting lasted two days and many excellent papers were given and discussed. The timing of the Symposium coincided with our class, so we took advantage of it. The substance of the papers was of general interest and of specific practical importance for many students.

One student and the author attended the White House Conference on Nutrition and participated in as many of the panel discussions as possible. The results of this Conference were often the subject of class discussions for all classes since that time. Similarly, the Third Hemispheric Conference on Nutrition provided some clear and very current information about nutrition that also came back to the class as part of either lectures or discussion.

One of the unusual aspects of this course is the serving of food in class. Students are encouraged to prepare a dish, ordinary or extraordinary, and calculate the nutritional value of it; then serve it to the class. This is a very practical approach to nutrition and it generates considerable enthusiasm and interest. The nutritional value is computed from standard sources such as the *Composition of Foods* (7) (obtainable from the Supt. of Documents, Washington, D. C.) or *Food Values* (4). A ditto sheet is usually prepared, giving the protein, calorie, fat, mineral, and vitamin content. The exercise itself is useful, the information generates discussion, and the food is always a pleasure or a surprise. Some of the foods which have been served during class will give an idea of the variety we have had: homemade cottage cheese, peanut bread, garbanzo patties, high protein muffins, a special survival food for backpacking in the mountains, soybean casserole, supercheap foods, poverty beans, bread made with CSM (corn-soy-milk), kasha, home fermented beer, yogurt, cider and so on. We have fun doing this and, at the same time, our discussions often integrate the practical aspects of nutrition with some of the functions of the human body, i.e., human physiology.

Over the period of several years that this course has been given, we have had groups of students doing surveys of the campus population with regard to nutrition. Within the first week we ask each student to complete a questionnaire about food habits, likes or dislikes, excesses, drug use, and so on. The results are tabulated and then distributed to the members of the class and become part of our class discussions. Some groups of students have also done surveys, for example, on the use of contraceptive pills in relation to appetite, weight gain, and nutrition. In this instance, all the women on campus were given a questionnaire and the computer used to tabulate the returns. The results were distributed on campus and they were useful in obtaining an understanding of the range of use and reactions to "the pill."

The relationship of drug use to nutrition was the subject of another questionnaire. The retrospective questionnaire covered the use of coffee, tea, alcohol, the pill, pot, acid, and other drugs. Student observations and comments about themselves, based on their own behavior and use of these drugs, was related to nutrition where possible. Of course, it also led to a discussion of drugs in general and this was not ignored.

Some of the social aspects of the course might be mentioned, since they show some of the other ways in which the courses extended beyond the classroom. For example, a small vegetarian restaurant was started by one group of students and a good food co-op by other members of the class. The cooperative (now known as the Good Food Coop) has expanded to over 800 members, including many townspeople and others from neighboring villages. The co-op has served an educational function in the community and has brought townspeople and students together in a common effort.

The Antioch Community Garden was another activity that was started by students in the Nutrition class. The garden was located on campus behind the Science Building, since this provided easy access and visibility to the whole community. About one quarter of an acre of golf course turf was turned under, fertilized with manure, campus leaves and compost, and then planted to vegetables of many different types. However, it was not just people from the Nutrition course that worked in the garden; many students from various courses and some townspeople helped with various phases of the work. Our lightly administered rule on harvesting was that the garden was open to anyone who was willing to do a little

work. In actuality, there were enough tomatoes, squash, lettuce, corn and other vegetables for people to wander by before dinner and pick up some fresh produce. The garden was a good place for discussions and it frequently became a small learning center related to nutrition, soils, biological control and many other subjects.

In conclusion, I would like to emphasize that, for me, this has been a satisfying general education course in biology. Student motivation was high, perhaps because many of the students realized that they had never really looked into this aspect of science, i.e., the science of food and health, and that maybe it would be a useful thing to do. Another reason for student interest in the course was the concern in the nation and the world about certain aspects of nutrition, such as malnutrition and its effect on brain development, child development and on learning. Once the student is committed to the course, he develops a greater appreciation of the biological and chemical aspects of life. Often this leads him to choose further work in the basic sciences.

In closing, I would like to relate the best compliment I heard about the course. A student came up to me and said, "I really am enjoying your nutrition course, Walt." And I said that was good, but I didn't know that he was enrolled in it. He said, "I'm not, but I get a lot out of it from the discussions at dinner by people who are taking the course." The students make the course what it is by their willingness to work, so we seem to have a reasonably effective teaching-learning situation in the Nutrition class.

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REGIONAL NEWS

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Keystone Junior College
La Plume/Dingman's Ferry, Pennsylvania

When Keystone Junior College agreed to help in the operation of a Youth Conservation Corps (YCC) camp in the Delaware Water Gap National Recreation Area last summer, we considered our participation as an interesting venture and probably a one-time thing. It turned out to be the key to an educational adventure: cooperation with the National Park Service in developing and executing an environmental study program with, we believe, enormous potential for the public and for Keystone.

Howard Jennings, instructor in biology, was named Director of the YCC camp, with Dr. Michael W. Mould, Director of Athletics, as his assistant. Cooperating in the program were the University of Scranton and Worthington Scranton Campus of Penn State University.

The camp operation was conducted so successfully that it attracted the attention of National Park Service personnel, notably Peter DeGelleke, Superintendent of the Water Gap Recreation Area.

At this time, the Army Corps of Engineers was acquiring properties for the area and turning them over to the Park Service for administration. One of the properties was a resort known as Honeymoon Haven, which occupied 38 acres in the Pocono Mountains near Dingman's Ferry, on the Delaware River not far from New York and Philadelphia.

Park Service officials saw Honeymoon Haven as a natural site for an environmental studies center -- a means of implementing its new emphasis on education as a high-priority item in its national program. The educational effort calls for cooperation with institutions competent to develop environmental studies.

The success of the YCC camp led the Park Service to offer the environmental center program to Keystone. Although the college campus is 15 miles northwest of Scranton and about 80 miles from the Pocono site, trustees and administrators decided the job could be done and certainly was worth doing.

Dr. Harry K. Miller, Jr., President of Keystone, told the faculty: "We realized the problems that might be encountered, but we recognized that a cooperative endeavor of this type offered much potential for the college and presents a major opportunity to embark upon new programs and courses, for Keystone and with other schools and colleges."

The Park Service appeared equally enthusiastic. Mr. DeGelleke told us: "The availability of this facility and the cooperation of Keystone offer an outstanding opportunity to produce a program that we believe can pioneer in demonstrating the new and ever-broadening contributions that our national park areas can make to society today."

Here was Keystone, about to take over 38 acres in the wilderness (with adjacent land at our disposal),

59 cabin units, a dining hall with a complete kitchen, a laundry building and a number of other ancillary structures, an outdoor pool, an indoor pool, bowling alley and other recreational facilities -- everything in excellent condition -- and the big question: "What do we do with it all?"

Here's what we've come up with to date: Without filling in the fine details, Keystone and the Park Service propose to offer, for users of the Gap Recreational Area, courses relating to the use of leisure time, recreation, and resort and land management. For paraprofessional Park Service employees and outdoor-recreation specialists, there will be career-related courses.

The Park Service seeks also to provide courses for family groups and retired persons, aimed at encouraging the enjoyment of, and respect for, natural resources and the environment.

Beyond that, it would seem the sky's the limit. Keystone is looking toward a multipurpose center suitable for research in the life and behavioral sciences, new college curriculums, field experience supplementing existing programs at Keystone and other institutions of higher learning (such as the archaeological digs conducted by another Pennsylvania college at the Pocono Center site over the past few summers), short-term courses, seminars, and workshops related to the environment. We are thinking also of field education in cooperation with regional public school districts, programs in the fine and performing arts for Keystone and cooperating institutions, a base for cultural programs, family seminars, and a summer extension campus.

My role will be to administer programs developed by advisory committees -- organizing, promoting, recruiting staff, and coordinating the multiple efforts of those involved in the Center's offerings.

Our first-phase program will be principally exploratory, with a small-scale operation for perhaps 120 participants at a time. By 1973-74, we expect to be able to accommodate as many as 300 students at a time in a full-scale operation.

We see hard work and headaches, but long-range benefits in view of the growing need to get down to fundamentals in teaching the public how to preserve and enjoy the earth.

The Consultants Bureau

AIBS Staff

The Bureau was conceived and developed by the Commission on Undergraduate Education in the Biological Sciences (CUEBS) in 1964, in recognition of the fact that many colleges and universities do not have the time, money, or expertise to effect the changes necessary to keep their programs in line with the rapidly changing nature of their discipline. Satisfied with its effectiveness and gratified with its acceptance by the academic community, the program was established on a continuing basis by OBE through a grant from the National Science Foundation in July, 1968, and is now administered by the Education Division. Three major services are involved: facilities consulting, curriculum consulting, and consulting on the planning and direction of workshops and meetings on innovations in teaching.

THE FACILITIES BUREAU

Problems relating to facilities and equipment are generally more precisely identifiable and manageable: "how much per square foot should a modest greenhouse cost?","what are the space requirements for a warm-animal room?", and so on. More often than not, such questions can be answered through the mail by one of the facilities consultants having a particular competence in these matters. An institution may submit the complete plans for a new building to a facilities consultant, who is often able to spot serious problems overlooked by competent architects. The services and arrangements for facilities consultation may not involve an on-campus visit as the facilities packet contains a considerable amount of self-help materials.

CURRICULUM CONSULTATION

An application for the consulting service, contained in a packet of materials sent upon request, identifies the general and specific areas upon which counsel might be requested. A request might be very general "to review the overall curriculum for majors, non-majors, and service programs," or rather specific "to assist in developing a program in urban ecology." The application generally comes from a department chairman, but they have also been submitted by deans, presidents, and even young-turk faculty members. It is evident, then, that the final report can be used by a dean to prod a behind-the-times department, by a department chairman to challenge a tightwad dean for support, or by faculty to challenge their recalcitrant colleagues. The beneficiary in any event is the undergraduate student, whose education has in all too many instances been sadly neglected and shortchanged.

An extensive questionnaire, completed by the applicant, provides the requisite background to facilitate and expedite the on-campus consulting visit. Typically, a team of two consultants conducts a 2-day visit, meets with personnel, analyzes programs, and examines physical resources. The analysis and recommendations of the team are contained in a report to the applicant. At this juncture, the burden of responsibility for program alteration rests neither on the Bureau nor the consultant, but on the institution.

The Bureau has been fortunate indeed to retain distinguished biologists experienced in various aspects of biological education on its roster of consultants. Since its inception, the Bureau has made available the expertise of well over a hundred such individuals who serve a 3-year term. This turn-over practice enables the development of an ever larger reservoir of talent. The wide geographic distribution of consultants helps to minimize transportation time and costs for the consultant and the host institution.

WORKSHOPS AND MEETINGS

Workshops and meetings may be devoted to innovations in teaching and related topics and may involve students, faculty and administrators in a region defined by the host institution. The primary intent of the event must

EDUCATION DIVISION PUBLICATIONS

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Since your address label is on the reverse side of this page, you need not supply your name and address unless you desire an address correction. All publications are free except for the *Handbook for Departmental Chairmen.*

____Please add my name to your mailing list to receive *Education Division News.*
____Please send available back copies.
____*Careers in Biology*
____Visiting Radiation Biologists Program brochure
____Student Chapter manual
____The Consultant Bureau packet. 1967. (CUEBS publ. No. 7) Single copies only.
____Guidelines for planning biological facilities. 1966. (CUEBS publ. No. 16)
____*Environmental Education: The Adult Public.* Conference report. 1970
____*Directory of Departmental Chairmen*
____*Handbook for Departmental Chairmen* (Enclose $1, please)
____Reprint: "Accreditation, Many Ways to Lose, No Way to Win." Creager and Ehrle. *BioScience.* April 1971.
____Reprint: "Attributes of Biologists in Two-Year Colleges." Creager and Ehrle. *BioScience.* February 1971.

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be to improve instruction in undergraduate biology, in accordance with the grant which supports the Consultants Bureau. As a general guideline, these events may involve as much as two full days time and may make use of one consultant per 15-20 participants. The Consultants Bureau will cover the expenses and honoraria of the consultants but cannot provide for any expenses of participants.

To make application for hosting a workshop or meeting, write a letter to the AIBS Education Division stating the proposed time and place of the event and the expected number of participants. Indicate the name of the sponsoring institution, outline the proposed content of the event, and state the intended purpose of the meeting. This letter will serve as an application and none of the forms in the packet need be completed.

You will be put in contact with one or more consultants who will assist you in planning and directing your workshop or meeting. Consultants will submit a written report following the event only if you express a desire to have such a report. However, a brief report from you to the Consultants Bureau describing the outcome of the event would be useful to us in evaluating the effectiveness of this new type of service.

COSTS

And what of costs? Overall costs for a visit average $300 for the consultant's typical 4 days of service and $100 travel and per diem. For two consultants, then, the cost averages $800. In one or two instances, the grant has defrayed the entire cost; likewise in a few instances, the requesting institution has defrayed all costs. Between these extremes are the typical situations. During the past year, institutions have covered approximately 60% of the costs. We feel it important that the institution have a financial stake in the program, but feel as strongly that the Bureau should assume full costs wherever educational needs exist and funds are wanting.

AN INVITATION

Finally, like the biological organism, a program demands nurture and nutrient in its growth and development. The programs are reviewed periodically and modified accordingly. We invite your further questions and certainly your use of the services.

PROJECT BIOTECH

Project BIOTECH will produce over 200 skill modules during the next three years. These modules are intended to be self-instructional and are designed to assist students in mastering various biotechnical skills and techniques.

If you would be interested in further information on any of the following aspects of the project, please write us describing your interests.

- developing a module (indicate topics on which you feel competent to develop a module)
- attending a module developers workshop if one were held
- reviewing modules prepared by others (indicate subject areas in which you could serve as reviewer)
- how your institution might use modules, e.g., in existing courses/programs, for students in technical programs, on the job training, in new courses/programs, for students in academic programs, other areas
- hosting a module developers workshop

Feel free to include any additional comments or questions you have about the project and mail your letter to:

Project BIOTECH - AIBS
3900 Wisconsin Avenue, N.W.
Washington, D. C. 20016

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HOW TO SUBMIT MANUSCRIPTS

The purpose of the *Education Division News* is to provide for the exchange of ideas among members of the biological community who are concerned with educational matters. This, of course, includes administrators, faculty members, and students - those individuals for whom the whole educational venture exists.

In order to maximize the number of different ideas presented in this newsletter, we ask that you submit short articles not exceeding 3,000 words. If possible, these should be typed in 52 character lines, including spaces, with indentations of 3 spaces at the beginning of each paragraph.

While not every one of the following features will appear in every issue, perhaps this list will stimulate your thinking about what you might like to submit.

BIO-STUDENT'S VOICE - Ideas from AIBS Student Chapters and students' views of programs and directions in biological education.

DIALOGUE - Articles chosen to stimulate thinking and exchange of ideas about the long-term goals of education.

LETTERS TO THE EDITOR - A new feature which we hope will facilitate dialogue.

CHAIRMAN'S CORNER - Another new feature which provides a place for chairmen to share their ideas.

CROSS-FERTILIZATION - A place for describing good ideas which are easily transportable to other situations.

VIEWPOINTS - A feature designed for presenting stimulating ideas similar in style to the Viewpoints which were carried in CUEBS News.

FUTURISTICS - A feature devoted to the consideration of the future of education.

GRANTSMAN'S PAGE - Articles on how funding agencies operate and how to write proposals will be included here.

REGIONAL NEWS - Articles describing specific programs in particular locations which will be chosen to maximize geographic diversity.